

REMARKSInformation Disclosure Statement

A Supplemental Information Disclosure Statement (IDS) is being filed concurrently herewith. Entry of the IDS is respectfully requested.

By this amendment, the specification has been amended to include patent numbers of issued patents corresponding to the serial numbers of patent applications incorporated by reference. Claims 25-60 are pending in the application. Claims 25, 26, 40, 50, 51 and 53 have been amended to recite the processing of electronic representations of a region of interest to generate images that are transferred from a processor to a display. Claims 61-80 have been added. Applicants believe no new matter has been added and support for the claims is found as a minimum with respect to Figure 4 and the related description found on page 23, line 8 through page 25, line 24.

Double Patenting Rejection

Claims 25-60 have been rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims of U.S. Patent No. 5590658 and 5690114.

The present claimed amendments are believed to obviate the double patenting rejection. Further, the applicants are prepared to file an appropriate terminal disclaimer in this application if needed to overcome the double patenting rejection.

Rejections Under 35 USC § 103

Claims 25-60 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Shinomura et al (US5295485) alone or further in view of Kitney et al (US5257629). Claims 25, 26, 40, 50, 51 and 53 have been amended to overcome the rejection by reciting a memory in the data processing housing

and the display of ultrasound images transferred from a processor to a display. The display can be integral with the processor or located at a site remote from the processor. The references do not recite a summing circuit that generates an electronic representation of the region of interest, nor a data processor unit having a memory, a processor and a display for storing, processing and displaying ultrasonic images. This invention provides the advantage of being able to forward an electronic representation of a region of interest generated in a hand-held scan head to a data processing and display circuitry. The invention also makes use of signal processing circuitry associated with ultrasonic transducers, drive circuitry, preamplification circuits and gain control circuits, control and multiplexer circuits integrated on small CMOS chips. The embodiments of the present invention do not have to accommodate increases in circuit scale that dictate the use of specific ultrasonic scanning modes as needed by Shinomura et al [Column 10, lines 49-58]. The cited references fail to disclose or suggest the advantages and structures.

CONCLUSION

In view of the amendments and remarks, it is believed that claims 25-80 are in condition for allowance, and it is respectfully requested that the application be passed to issue. If the Examiner feels that a telephone call would expedite the prosecution of this case, the Examiner is invited to call the undersigned at (508) 879-5700.

Respectfully submitted,

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MARKED UP VERSION OF AMENDMENTSSpecification Amendments Under 37 C.F. R. § 1.121(b)(1)(iii)

Beginning on page 1, line 3 and ending on page 3, line 10:

This application is a continuation-in-part of U.S. Serial No. 09/123,991 filed on July 27, 1998, now U.S. Patent No. 6,106,472, which is a continuation of U.S. Serial No. 08/971,938 filed on November 17, 1997, now U.S. Patent No. 5,957,846, and is also a continuation of U.S. Serial No. 08/981,427 deposited on December 29, 1997, now U.S. Patent No. 5,964,709, which is the U.S. National Phase application of PCT/US96/11166 filed on June 28, 1996 which is a continuation-in-part application of U.S. Serial No. 08/599,816, filed on February 12, 1996, now U.S. 08/496,804, filed on June 29, 1995, now U.S. Patent No. 5,590,658, the entire teachings of which are incorporated herein by reference.

Beginning on page 12, line 3 and ending on page 12, line 8:

Such devices are described in copending U.S. Patent Application Serial No. 08/496,915, now U.S. Patent No. 5,763,785, entitled, "Integrated Beam Forming and Focussing Processing Circuit for Use in an Ultrasound System," by Alice M. Chiang and copending U.S. Patent Application Serial No. 08/496,463, entitled, "Integrated Delay Processing Circuit," by Alice M. Chiang, both of which were filed on June 29, 1995. Both patent applications are incorporated herein by reference.

Claim Amendments Under 37 C.F.R. § 1.121(c)(1)(ii)

25. (Amended) An ultrasound imaging system comprising:
- a hand-held probe housing having a transducer array circuit, the transducer array circuit generating a continuous time input signal;
 - a beamformer circuit that samples and delays the continuous time input signal and generates discrete time sampled signals;

a summing circuit that generates an electronic representation of the region of interest with the delayed discrete time sampled signals;

an interface unit connected to the probe housing;

a data processor housing having a memory and a data processor;
and] , the data processor generating ultrasound images from the electronic representation of the region of interest;

a cable connecting the interface unit to the data processor housing such that the electronic representation is conducted along the cable to the data processor[.] ; and

a display for presenting ultrasound images transferred from the processor.

26. (Amended) The system of claim 25 wherein the hand-held probe housing is selected from the group comprising a linear array probe, a curved array probe, and a phased array probe.

40. (Amended) An ultrasound imaging system comprising:

a hand-held probe housing having a [two dimensional] transducer array, the transducer array receiving signals from a region of interest and that generates an input signal;

a beamformer circuit that samples the input signal and that generates discrete time sampled signals, the beamformer circuit delaying the discrete time sampled signals;

a summing circuit that generates an electronic representation of the region of interest with the delayed discrete time sampled signals; and

a cable that connects an interface unit to a personal computer having a memory, a processor, a graphical user interface and a display such that the electronic representation is conducted along the cable to the computer[.] and is processed in the processor to generate ultrasound images, the ultrasound images being transferred to the display.

- 50. (Amended) The system of claim 40 wherein the [two dimensional] transducer array comprises a plurality of rows, each row comprising a linear array.
- 51. (Amended) The system of claim 40 wherein the [two dimensional] transducer array comprises a plurality of parallel rows such that one of the rows is longer than another of the rows.
- 53. (Amended) The system of claim 40 wherein the personal computer further comprises a [windows] Windows operating system.

Please add new Claims 61 through 80.

- 61. (New) The system of claim 25 wherein the display is integral with the data processor.
- 62. (New) The system of claim 25 wherein the display is located at a site remote from the data processor.
- 63. (New) The system of claim 25 further comprising generating a plurality of images of the region of interest for display and selecting one of the images for display on the display.
- 64. (New) The system of claim 63 further comprising storing the selected image in a memory.
- 65. (New) The system of claim 63 wherein the plurality of images further comprises images of moving objects processed using a Doppler processor.

66. (New) The system of Claim 25 wherein the electronic representation of the region of interest further comprises one of digital signal data and analog signal data.
67. (New) The system of claim 25 further comprising a video compression device in communication with the data processor.
68. (New) The system of claim 40 wherein the display is integral with the data processor.
69. (New) The system of claim 40 wherein the display is located at a site remote from the data processor.
70. (New) The system of claim 40 further comprising generating a plurality of images of the region of interest for display and selecting one of the images for display on the display.
71. (New) The system of claim 70 further comprising storing the selected image in a memory.
72. (New) The system of claim 70 wherein the plurality of images further comprises images of moving objects processed using a Doppler processor.
73. (New) The system of Claim 40 wherein the electronic representation of the region of interest further comprises one of digital signal data and analog signal data.
74. (New) The system of claim 40 further comprising a video compression device in communication with the data processor.
75. (New) An ultrasonic diagnostic imaging system comprising:

an ultrasonic array probe;
a personal computer platform having a central processing unit (CPU) and comprising:

a beamformer control circuit to control a plurality of differential delays used by a beamformer in response to signals from a region of interest;

signal processing software for performing at least one of multi-dimensional and Doppler processing of processed signals from a region of interest; and

display processing software for performing display processing of said processed signals; and

a display coupled to said personal computer platform to receive processed signals for display of an ultrasonic image.

76. (New) The ultrasonic diagnostic imaging system of claim 75 wherein said personal computer platform further comprises a memory.
77. (New) The ultrasonic diagnostic imaging system of claim 75 wherein said signal processing software and said display processing software are executed by said CPU.
78. (New) An ultrasonic diagnostic imaging system comprising:
an ultrasonic array probe; and
a personal computer platform having a central processing unit (CPU) and comprising:
a buffer memory to store shared digital data from a region of interest;
signal processing software for processing said shared digital data from the region of interest to generate digital images of the region of interest; and

a display coupled to said signal processing software for displaying said digital images of the region of interest.

79. (New) The ultrasonic diagnostic imaging system of claim 78 wherein said personal computer platform further comprises a scan conversion circuit.
80. (New) The ultrasonic diagnostic imaging system of claim 78 wherein said personal computer platform further comprises a beamformer control circuit.